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Cyathus badius and *C. earlei* reported from the Brazilian Atlantic rainforest

Rhudson Henrique Santos Ferreira da Cruz*[1], Marcos Mateus Barros Barbosa[3] & Iuri Goulart Baseia[2]

[1]*Programa de Pós Graduação em Sistemática e Evolução &*
[2]*Departamento de Botânica, Ecologia e Zoologia, Universidade Federal do Rio Grande do Norte, PO Box 59072-970, Natal, RN, Brazil*
[3]*Programa de Pós Graduação em Biologia de Fungos, Universidade Federal de Pernambuco, PO Box 50670-420, Recife, PE, Brazil*

* Correspondence to: *rhudsoncruz@yahoo.com.br*

Abstract — Two rare species of *Cyathus*, *C. earlei* and *C. badius*, were found in remnants of Brazilian Atlantic rainforest located in the city of Natal, Rio Grande do Norte state, Brazil. Both species are new records for South America, and *C. badius* represents the second occurrence for the world. Descriptions, taxonomic remarks, and illustrations of these species are provided.

Key words — *Basidiomycota*, gasteromycetes, neotropics, *Nidulariaceae*, taxonomy

Introduction

For many years the bird's nest fungi (*Cyathus* Haller, *Crucibulum* Tul. & C. Tul., *Mycocalia* J.T. Palmer, *Nidula* V.S. White, and *Nidularia* Fr.) were classified in the *Nidulariaceae* Dumort. (Brodie 1975). This gasteroid group has suffered substantial classification changes since Hibbett et al. (1997) and Moncalvo et al. (2002), who placed the *Nidulariaceae* in the *Agaricales* in an uncertain position among the 'euagarics clade'. However, recent molecular studies indicate that the *Nidulariaceae* occupies a well-defined position in the *Agaricales* where it forms a sister group with the *Cystodermataceae* Locq. (Matheny et al. 2006).

Eleven *Cyathus* species have been reported from Brazil (Trierveiler-Pereira & Baseia 2009a, b, Trierveiler-Pereira et al. 2009), but this seems low compared with the 45 taxa already known (Kirk et al. 2008). Recent estimates of the fungal kingdom (Hawksworth 2001, Blackwell 2011), suggest several unknown species of *Cyathus* still await discovery in tropical forests.

Cyathus species typically occur in forests under decomposing wood and leaves (Brodie 1975). Due to the small basidiome size and limited number of specialists conducting research in neotropical regions, these species are often underestimated or ignored (Baseia & Milanez 2001). The present study aims to broaden the existing knowledge of *Cyathus* species in the Brazilian Atlantic forest.

Materials & methods

Collections were made during the rainy seasons of 2004 to 2009 in the Parque Estadual Dunas do Natal (5°46′S 35°12′W) in the city of Natal, Brazil. Macro- and microscopic characteristics were based on the specialized literature (Calonge 1998, Baseia & Milanez 2001, Brodie 1975, 1984, Brodie & Dennis 1954, Zhou et al. 2004, Zhao et al. 2008). Abbreviations used in spore descriptions follow Zhao et al. (2008): Qm is the mean of the quotient of spore length (represented by L) and width (represented by W) and n is the number of spores observed. Colour codes are according to Kornerup & Wanscher (1978) and vouchers are deposited in the UFRN Herbarium (Thiers 2012).

Taxonomy

Cyathus badius Kobayasi, Bot. Mag., Tokyo 51: 755 (1937). Plate 1

Peridium infundibuliform, 8–10 mm high, 5–8 mm wide at the mouth, not expanding at the top or tapering abruptly at the base; young fruit bodies with margin curved inwards. Attached to the substrate by a conspicuous and velvety emplacement, 3–5 mm in diameter, brown (6E4). Exoperidium concolourous with the emplacement, shaggy, wooly, smooth to plicate, with 0.3 mm between folds, covered with irregulars tufts of hair; mouth minutely fimbriate, with a 0.2 mm long chocolate-coloured tomentum (6F4). Endoperidium smooth to minutely plicate, with 0.5 mm between folds, light brown to orange (5F1–6D4), slightly shiny. Peridioles 11 per basidioma, light grey to black (1C1–6F3), 2–2.5 × 2–2.2 mm; tunic present, thin, hyaline to yellowish, usually with a distinctly single-layered cortex. Basidiospores 13–19 × 9–11 μm (Qm = 1.66; L = 17.1 μm; W = 10.3 μm; n = 30), smooth, hyaline, ovoid to elliptical, occasionally subglobose, thick-walled (1.9–3.2 μm).

Substrate: Growing on decaying wood.

Specimens examined: **BRAZIL. Rio Grande do Norte: Natal,** Parque Estadual Dunas de Natal, 18.VI.2009, leg. M.M.B. Barbosa & R.H.S.F. Cruz (UFRN 1318); 03.VI.2008, leg. E.P. Fazolino & I.G. Baseia (UFRN 562).

Distribution: Japan (Kobayasi 1937), Brazil.

Taxonomic remarks: *Cyathus badius* forms part of the *olla* group in the traditional classification by Brodie (1975) and the "pallidum" group in the molecular classification by Zhao et al. (2007). According to Brodie (1975), it is morphologically similar to *C. africanus* H.J. Brodie and *C. earlei*. In relation to *C. africanus*, differences are notable in the lack of conical patterns in tomentum

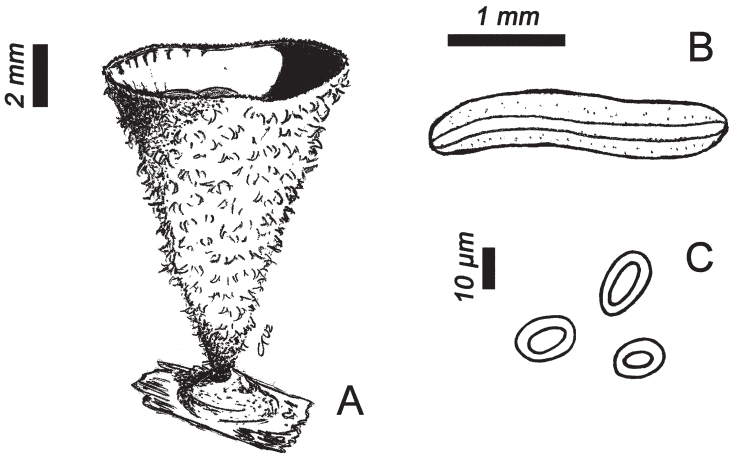

Plate 1. *Cyathus badius*.
A. Basidioma. B. Peridiole with distinct single cortex. C. Basidiospores.

tufts. The spores are also significantly larger in *C. badius* compared with *C. africanus* (8.5–12 × 6.5–8.5 µm). When compared with *C. earlei*, there is a marked difference in the cortex region of the peridiole, which is clearly double in *C. earlei* and simple for *C. badius.* Originally described from the Japanese island of Titizima (Kobayasi 1937), this is the first record of this species from South America and the second for the world.

Cyathus earlei Lloyd, Nidulariaceae: 26 (1906). Plate 2

Peridium infundibuliform, 7–9 mm high, 5–8 mm wide at the mouth, not expanding at the top or tapering abruptly at the base. Attached to the substrate by a conspicuous emplacement, 2–5.5 mm in diameter, brown (6F5–6F6). Exoperidium concolourous with the emplacement, smooth to plicate, with 0.5 mm between folds; hirsute, covered with irregular tufts of hairs; mouth minutely fimbriate, with 0.2 mm long tomentum. Endoperidium plicate, with 0.5 mm between folds, greyish brown (7F3), contrasting with the exoperidium. Peridioles 12–16 per basidioma (average of 14), grey (3E1), 2–2.5 × 1.5–2 mm; tunic present, thin, hyaline, silvery-white with double layered cortex. Basidiospores 15.2–17.8 × 9.5–11.4 µm (Qm = 1.55; L = 16.3 µm; W = 10.5 µm; n = 30), smooth, hyaline, ovoid to elliptical, thick-walled (1.9–2.5 µm).

Substrate: Growing on decaying seeds.

Specimens examined: **BRAZIL. Rio Grande do Norte: Natal,** Parque Estadual Dunas de Natal. 10.VII.2004, leg. I.G. Baseia, P.P.T. Lacerda (UFRN 1, 2).

Distribution: Cuba, Hawaii (Lloyd 1906), Puerto Rico, Mexico, West Indies (Brodie & Dennis 1954), Brazil.

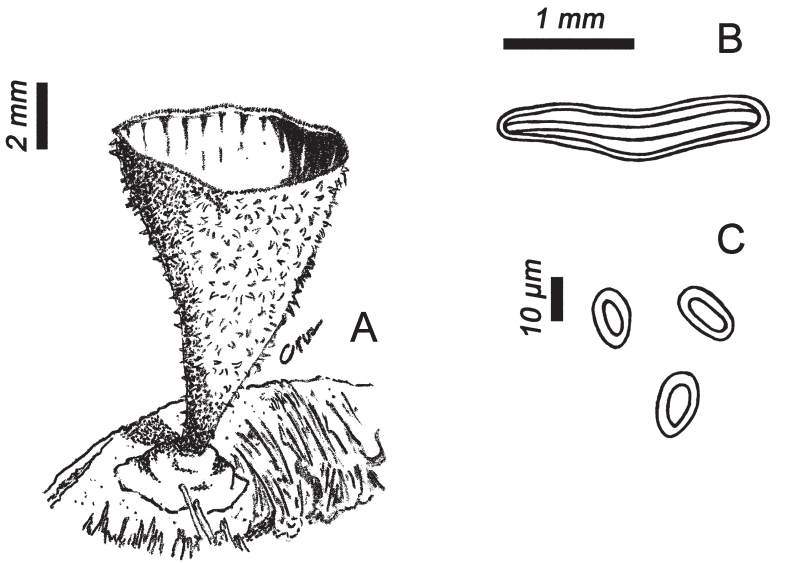

Plate 2. *Cyathus earlei*.
A. Basidioma. B. Peridiole with double layered cortex. C. Basidiospores.

Taxonomic remarks: *Cyathus earlei* belongs to the *olla* group according to the traditional classification by Brodie (1975) and the "pallidum" group based on molecular data from Zhao et al. (2007). Macroscopically it can be confused with *C. olla* (Batsch) Pers. Distinctive differences in *C. earlei*, however, are the double-layered cortex (cf. the simple cortex in *C. olla*), the smaller basidiomata (cf. 10–15 mm in *C. olla*; Brodie 1975), the larger basidiospores (cf. 10–14 × 6–8 µm in *C. olla*; Brodie 1975), as well as smaller peridioles (cf. up to 3.5 mm in *C. olla*; Brodie 1975). In contrast to other *Cyathus* species that are normally found on decaying wood or dung, this species occurred on decaying seeds of native plants. This is the first record of *C. earlei* from South America.

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